shown without magnifying glass, a nowadays common feature among digital still photo- as well as video-cameras. It's true that a general selection of motive is facilitated by such a procedure, but manual focusing is hampered by the simple reason that the electronic screen must be viewed from sufficiently far distance, where an eye can accomodate. It's furthermore an image of relatively low intensity for outdoor use in sunshine, an illustration being the C-3000 zoom digital camera from Olympus Optical Co (Japan) having two viewfinders: A separate optical one and an electronic (LCD) without magnifier. The DCR-VX1000E video camera from Sony has one electronic viewfinder only: A micro-displayer being viewed through a magnifier. Methods aiming at depth of field-improvements, based upon availability of more than one differently focused image, depicting the same scene and applicable to electronic or optical viewfinders, are disclosed in a Swedish patent application #0004836-3, being brought further in the subsequent, previously mentioned PCT patent WO 02/059692, from which selected aspects will now be discussed :
The simplest procedure, relevant for a viewfinder image, created by electronic means, is apparently some pixel-by-pixel averaging of the differently focused images involved. However, the Average-image (M) contrast will be reduced due to inclusion of focused as well as out-of-focus image-information: The unfocused image-components are usually settling upon the final image like a haze (~~noiee~~ noise), which is hardly acceptable for a resultant image, but might nevertheless pass for a view-finder, particularly when considering the associated fast image processing and moderate computing-capacity needed. The average-image method may be further developed, according to another more sophisticated and resource-consuming mode, where an essential part of the above-mentioned image haze from un-focused information is extracted from the Average-image so that contrast and image quality is bettered. A further improvement may be accomplished by means of introducing a simple segment-selection method, even though certain disturbances along edges may emerge, however this being of less consequence for sequences of changeable images rather than still photos.
Superposition of differently focused images is even feasible for an optical viewfinder, again ending up with weakening image contrast due to contributions from in-focus as well as out-of-focus image information, however still a potentially useful viewfinder application. One mode is to split the wavefront or aperture in at least two parts, then introduce different states of focus for these ray paths, by optical means, and finally perform an optical reunion of the two parts into one image, constituting a superposition of differently focused contributions (figure 3b).
Another and now time-related method is to introduce periodic change of focus, so that differently focused pictures alternate fast enough (ca >= 10 Hz) in order to create an illusive impression of images being merged for an observer, like what's happening when watching video or movies.
These above-mentioned methods, related to optical viewfinders, are here to be regarded as depth of field-improving techniques. The one camera viewfinder function is thus control of and - where applicable - manual setting of focus. This is furthermore repeated several times when operating a depth of field-improving camera with several focal planes to be focused upon.

focused for identical object distance, are connected. The two other sensors being differently focused are similarly coupled. The luminous flux generating an image of a certain state of focus is thereby doubled which - true - is not the same as to double the sensor sensitivity, yet the improvement will be significant and this pixel-by-pixel addition of images will also decrease the spatial noise, being different for the two sensors, and picture quality will increase correspondingly.

Referring to the mode of Interval Bracketing (cf above) and another 4-sensor design, it would be possible to join two sensors for registering the priority (middle) state of focus (P) and thereafter register the interval ends (P- and P+) with one sensor each. This will give us a better registration of priority focus, thanks to the doubling of the sensors, however the relative intensity from the three pictures must be electronically adjusted in order to obtain same average intensity.

No doubt, there remains a multitude of other practical ways to elaborate these focusing- and sensor-strategies but a further variative account of the same topic would hardly add much of new principles to this text. The examples given are illustrating the principles of the present invention, but do not confine the scope to that. 'Camera' and 'Digital Camera' with '~~Wiewfinders~~ "Viewfinder"' are denominations common in this text as regards the invention, but it should be emphasized that the invention is equally applicable to video-, surveillance-, lowlightlevel-, and TV-cameras plus Image-intensifier- and Infra-red cameras, just to mention a few other examples of instruments which may be focused, which may have finders and which are meant for permanent image registration, being suitable for a depth of field-improving technique.

Figure descriptions in brief

Figure 1 shows a depth of field-improving camera design, including the viewfinder. Figure 2 shows another such camera. Figure 3 A-D exhibits further examples of beamsplitter arrangements for a camera with finder and with depth of field-enhancement capability. Figure 4 A-C shows another advantageous design with a beamsplitter of dynamic character at the moment of exposure.

Figure 5 depicts a common digital still camera, being modified in order to produce depth of field-improved photos.

Designs exemplified

Figure 1 exemplifies a depth of field-improving camera with optical and electronic viewfinders, all having the capacity of extending depth of field, according to the invention: Simultaneous registration of up to 4 differently focused images is possible according to this set-up, using the four sensors D1, D2, D3 and D4. The split into different pictures is effectuated by means of the right-angled beamsplitter prisms RP, P1 and P2, where the mirroring surfaces are PS1, PS2 and PS3. These prisms are by preference made of light-weight glass with high refractive index, in order to shorten the